National Institute of Environmental Health Sciences
Your Environment. Your Health.

Superfund Research Program

The Superfund Research Program (SRP) supports practical research that creates benefits, such as lower environmental cleanup costs and reduced risk of exposure to hazardous substances, to improve human health. SRP funds colleges, universities, and small businesses, including the University of Arizona Superfund Research Center (UA SRC), to advance this work across the nation.

Research Highlights

Using plants to stop the spread of mine waste

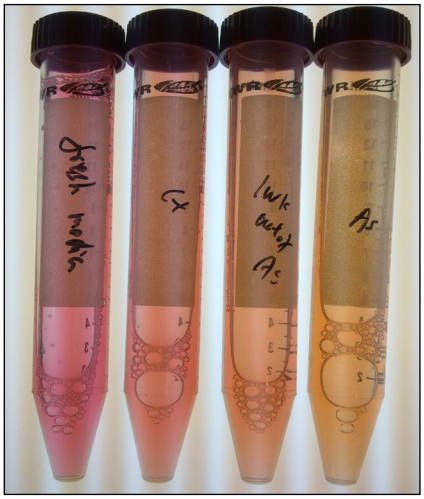
Specific types of plants and soil conditions are being investigated for their ability to stabilize areas contaminated with mine tailings. (Photo courtesy of UA SRC)

Work by UA SRC suggests that certain native plants significantly reduce dust from mine tailing sites.[1] Mine tailings, materials left over after removing the valuable portion of the ore, cover thousands of acres in the western United States. This finely crushed waste contains harmful metals like arsenic, and inhibits the growth of vegetation. Raina Maier, Ph.D., and her colleagues are developing a strategy for long-term management of mine waste sites, by identifying native plants of the desert southwest that will grow in these areas. Working with U.S. Environmental Protection Agency Region 9 and the site owner, the researchers started a field trial at the Iron King Mine and Humboldt Smelter Superfund site near Dewey-Humboldt, Arizona, in 2010, and are currently in Phase 3 of the trial. The positive results led to partnerships with four mining companies, who are now working with Maier's group to grow plants at their abandoned and active mining sites.

A new understanding of arsenic toxicity

A research team led by Walt Klimecki, D.V.M., Ph.D., found that chronic, low-dose arsenic exposure causes human cells to change their metabolism, specifically how they process sugar for energy, by using a process normally reserved for conditions of oxygen starvation.[2] This study suggests that arsenic tricks the cells by triggering their sensors for low oxygen conditions, even when the cells have abundant oxygen. This may have important consequences for arsenic-associated disease, because a similar shift in sugar metabolism has been observed in diseases such as diabetes and cancer.

Arsenic is thought to contribute to a diverse range of diseases, from cancer to heart disease to diabetes.[3] Despite having such a wide impact, the way in which arsenic exerts its toxic effects remains a question that the UA SRC hopes to answer with this study.



Exposure to arsenic causes changes in cellular metabolism, visualized in the laboratory as color changes in the medium. (Photo courtesy of UA SRC)

THE UNIVERSITY OF ARIZONA

UA SRC is studying the human and environmental risks associated with metal mining in arid environments and developing innovative remediation technologies to limit these risks. The arid climate of the southwestern U.S. brings unique challenges when it comes to contaminants in the environment.

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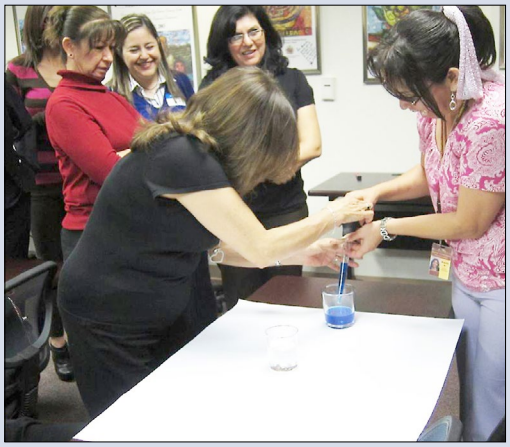
Community engagement along the border

The 2,000-mile border between the U.S. and Mexico is a unique arid region spanning four U.S. and six Mexican states. People residing along the border are at risk for exposure to a variety of environmental contaminants, including arsenic, trichloroethylene, lead, pesticides, and air pollutants.

As one of their outreach projects, UA SRC codeveloped bilingual training modules with Hispanic community health advocates, promotoras de salud, on various environmental themes relevant to the Arizona-Sonora, Mexico border. These modules, which cover topics such as arsenic and risk assessment, have been used in both countries and are freely available.[4] UA SRC is currently developing educational modules for tribal community colleges on the environmental and social impacts of mining on tribal lands.



Promotoras from the Regional Center for Border Health Inc. and Sunset Community Health Center participate in a hands-on activity that helps them visualize dispersion of a contaminant. UA SRC has partnered with promotoras, who provide environmental health information in primarily Spanish-speaking neighborhoods. (Photo courtesy of UA SRC)

Research overview

- Identifying indicators of successful revegetation at or near mining sites to stabilize mine waste and limit human exposure. (Raina Maier, Ph.D., rmaier@ag.arizona.edu)
- Studying how the properties of airborne dust affect wind transport of metal contaminants from mine wastes. (Eric Betterton, Ph.D., betterton@atmo.arizona.edu)
- Determining if inhalation of arsenic-containing dust during critical stages of development leads to changes in lung function as an adult. (R. Clark Lantz, Ph.D., lantz@email.arizona.edu)
- Understanding how mine waste gets into groundwater, and determining ways to clean up contaminated groundwater. (Mark Brusseau, Ph.D., brusseau@ag.arizona.edu)
- Examining cell metabolism to increase knowledge on how arsenic can induce lung cancer. (Walter Klimecki, D.V.M., Ph.D., klimecki@pharmacy.arizona.edu)

Sharing results

- UA SRC is providing culturally relevant education and teaching tools to affected communities, so they can better understand, and make informed decisions about, health issues related to mining. (Karletta Chief, Ph.D., kchief@email.arizona.edu)
- UA SRC is strengthening the ability of stakeholders in the U.S., Mexico, and tribal nations to address hazardous waste problems, by providing evidence-based information and innovative research products. (Raina Maier, Ph.D., rmaier@ag.arizona.edu)

Other contributions to advance science

- The UA SRC integrated, multidisciplinary training experience provides early-career scientists access to teams of diverse professionals, and encourages innovation to develop solution-oriented approaches to complex environmental health problems. (Raina Maier, Ph.D., rmaier@ag.arizona.edu)

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For more information on the National Institute of Environmental Health Sciences, visit **www.niehs.nih.gov**.

For more information on the Superfund Research Program, visit **www.niehs.nih.gov/srp**.

For more information on the University of Arizona Superfund Research Center, visit **http://superfund.pharmacy.arizona.edu**.

[1] Solis-Dominguez FA, White SA, Hutter TB, Amistadi MK, Root RA, Chorover J, Maier RM. 2012. Response of key soil parameters during compost-assisted phytostabilization in extremely acidic tailings: effect of plant species. Environ Sci Technol 46(2):1019-1027.

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